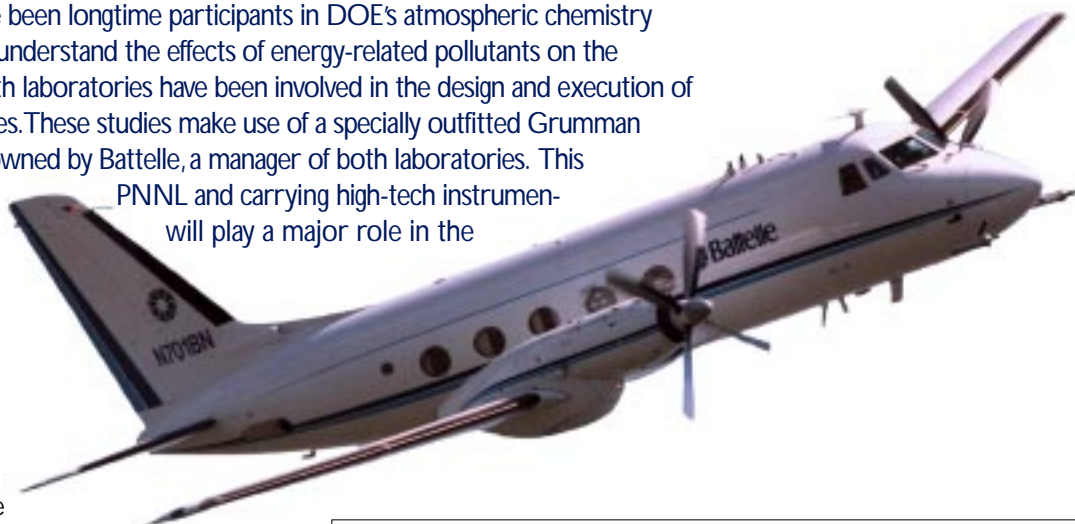


Gulfstream G-1 Aircraft

New England Air Quality Study, July - August 2002

The U.S. Department of Energy's Brookhaven National Laboratory (BNL) and Pacific Northwest National Laboratory (PNNL) have been longtime participants in DOE's atmospheric chemistry program. DOE has a mandate to understand the effects of energy-related pollutants on the atmospheric environment, and both laboratories have been involved in the design and execution of many complicated air-quality studies. These studies make use of a specially outfitted Grumman Gulfstream G-1 aircraft, which is owned by Battelle, a manager of both laboratories. This sophisticated aircraft, operated by PNNL and carrying high-tech instrumentation developed primarily at BNL, will play a major role in the New England Air Quality Study.



Sampling Flights

From July 11 to 26, BNL scientists will conduct daytime sampling flights using the G-1 aircraft, focusing mainly on the area from the Atlantic Ocean off the coast of Boston, Massachusetts, to Pittsburgh, Pennsylvania, in the west. Most of the sampling will be done in the lowest part of the atmosphere, about 2,000 feet above the surface. But four or five times on each flight, the plane will sample from as close to the surface as possible, about 500 feet, up to about 10,000 feet to determine the vertical distribution of pollutants and precursor chemicals. In addition, the BNL team will conduct vertical sampling flights over Pinnacle Park, New York, and over the *RV Ron Brown*, a ship operated by the National Oceanic and Atmospheric Administration, which will take ocean surface measurements off the New England coast.

During the second half of the study (July 27 to August 9), scientists from PNNL will conduct a series of nighttime flights for the Nighttime Aerosol and Oxidant Experiment (NAOPEX). These flights will take place off the Boston coast, sampling just after sunset and a few hours before sunrise. Scientists are interested in the chemical processes that occur between trace gases and aerosols in the nighttime air, without contributions from daytime photochemistry and fresh emissions. The G-1 will sample pollution over the greater Boston area, then fly several thousand feet above the ocean as the pollution from Boston moves eastward with the wind. Simultaneously, PNNL will track the air stream off the Boston coast and collect basic atmospheric data by releasing constant-altitude research balloons equipped with a simple chemistry instrument payload, including GPS for data transmission back to the G-1 aircraft. Scientists from Boston College, UCLA, Aerodyne Corp., the University of New Hampshire, Argonne National Laboratory, and GSSL, Inc. will be working with PNNL scientists on this part of the campaign.

Measurements and Instrumentation

Parameter	Instrument or technique
Ozone	UV absorption
Carbon monoxide	Non-dispersive infrared
Sulfur dioxide	Pulsed fluorescence
Nitric oxide, nitrogen dioxide, and total nitrogen oxides	Ozone chemiluminescent instrument designed and built at BNL
Volatile organic compounds	Gas chromatography/flame ionization
Aerosol scattering	Integrating nephelometer
Aerosol size distribution	Passive cavity aerosol spectrometer, forward scattering aerosol spectrometer, BNL differential mobility analyzer/condensation nuclei counter system
Aerosol absorption	Aethelometer
Aerosol composition	PILS, aerosol mass spectrometer
Particle number	Condensation nuclei counter
Ultraviolet radiation	Eppey pyranometer
Air temperature	Pt resistance thermometer
Dew point/frost point	Chilled mirror
Wind direction, speed	Gust probe
Altitude	Barometer
Position	GPS (global positioning system)
Air speed	Differential pressure transducer

In addition to the usual air-quality sampling instruments carried on the G-1, this study includes special instruments to measure aerosols, such as an aerosol mass spectrometer developed by Aerodyne Inc.; an integrating nephelometer to measure light scattering by ambient aerosols; and a Particle into Liquid Sampling System (PILS) developed at BNL to measure aerosol composition. Together, this array of aerosol instrumentation will provide a characterization of ambient aerosol composition with unprecedented detail for an aircraft measurement program.